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Raman scattering study of $SrTiO_3$: Bi ceramics with higher (x = 0.16) bismuth content

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The dielectric properties of 0.1-15 mol.% bismuth doped $SrTiO_3$ ceramics have been investigated systematically for decades. The temperature dependence of the dielectric permittivity suggests that the ferroelectric behavior at lower impurity content transits to mixed relaxor ferroelectric type when impurity concentration reaches 5 mol.%, and further to relaxor behavior for samples above 10 mol.% Bi content. Because of the impurity in ABO_3 perovskites, dipolar entities form polar nanodomains. In the very dilute limit each domain behaves as a non-interacting polar entity with a local dynamics. At higher concentrations of disorder, however, the domains can interact leading to a more complex relaxation behavior. Among the manifestations of such behavior is the formation of a glass-like relaxor state. Such formation results in a typical modification of low frequency lattice dynamics and should show in low frequency Raman spectra (see e.g. [1]). Yet to our knowledge Raman spectra of such ceramics with higher concentration of bismuth content have not been investigated up to now. So here we report temperature transformation of Raman spectra of $Bi_xSr_{(1-1.5x)}TiO_3$, x = 0.16 ceramics in a lower frequency range.

Raman spectra have been obtained with Jobin Yvon-Horiba T-64000 spectrometer and Ar^+ laser (514.5 nm, 50 mW), CCD detection with liquid nitrogen cooling, 600 s accumulation time. The polycrystalline ceramics samples were obtained from conventional mixed oxide powder. High-purity $SrCO_3$, TiO_2, and Bi_2O_3 powders were mixed for 6 h by ball milling in distilled water. The powders were calcined at 1100 °C for 6 h. After calcination, the powders were pressed at 20 MPa and sintered in a range of 1380-1195 °C in air for 4 h and furnace cooled. Details of sample synthesis and control are given in [2].

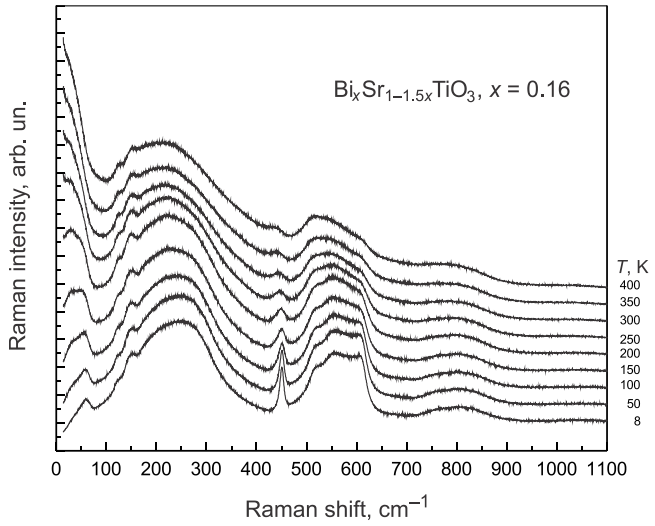

Figure 1. Temperature transformation of $Bi_xSr_{(1-1.5x)}TiO_3$ Raman spectra.

Typical temperature transformation of obtained spectra is shown in the figure 1. Results are discussed in comparison with earlier data [1] for ceramics with lower Bi content.

1. A. Almeida, P. Teles, M.R. Chaves, P.M. Vilarinho, J.L. Baptista, *Ferroelectrics* **294**, 49 (2003).
2. W. Chen, X. Yao, X. Wie, *J. Mater. Sci.* **43**, 1144 (2008).